# CLAIMS

What is claimed is:

1. An implant, comprising:
a substrate;
a structured surface formed on at least a portion of said substrate; and
a biocompatible coating deposited on at least a fraction of said structured surface.

2. The implant of claim 1, wherein said biocompatible coating is more biocompatible than said structured surface.

3. The implant of claim 1, wherein said biocompatible coating is more biocompatible than said substrate.

4. The implant of claim 1, wherein said biocompatible coating is softer than said structured surface.

5. The implant of claim 1, wherein said biocompatible coating is softer than said substrate.

6. The implant of claim 1, wherein said coating is formed by a thin film technique.

7. The implant of claim 6, wherein said thin film technique includes at least one deposition process selected from the group consisting of physical vapor deposition and chemical vapor deposition.

8. The implant of claim 1, wherein said structured surface includes a plurality of undercuts and said biocompatible material coats said plurality of undercuts in said structured surface.

9. The implant of claim 8, wherein said structured surface is porous and said biocompatible material coats interconnected pores beneath said structured surface.

10. The implant of claim 1, wherein said substrate includes at least one material selected from the group consisting of carbon-composite, stainless steel, cobalt-chromium, titanium alloy, tantalum, and ceramic.

11. The implant of claim 1, wherein said structured surface is defined by a material that includes a plurality of particles that are sintered together to form a continuous porous phase.

12. The implant of claim 1, wherein said structured surface is prepared by at least one method selected from the group consisting of sintering, flame spraying, acid etching, grit blasting, casting-in, forging-in, laser texturing, and micromachining.

13. The implant of claim 1, wherein said biocompatible coating includes at least one material selected from the group consisting of titanium, tantalum, carbon, calcium phosphate, zirconium, niobium, hafnium, hydroxyapatite, and tissue in-growth and/or on-growth facilitating proteins.

14. The implant of claim 1, wherein said biocompatible coating includes multi-layers.

15. The implant of claim 1, wherein said biocompatible coating includes nano-layers.

16. The implant of claim 1, wherein said implant is an orthopedic prosthesis.

17. A method for orthopedic surgery which comprises surgically positioning said implant of claim 1 within a vertebrate in need thereof.

18. An osteoconductive process, comprising contacting a bone under *in vivo* conditions with said implant of claim 1.

19. A composition for an implant, comprising:

a biocompatible material coated on a structured surface defined by a substrate.

20. The composition of claim 19, wherein said biocompatible coating is more biocompatible than said structured surface.

21. The composition of claim 19, wherein said biocompatible coating is more biocompatible than said substrate.

22. The composition of claim 19, wherein said biocompatible coating is softer than said structured surface.

23. The composition of claim 19, wherein said biocompatible coating is softer than said substrate.

24. The composition of claim 19, wherein said coating is formed by a thin film technique.

25. The composition of claim 24, wherein said thin film technique includes at least one deposition process selected from the group consisting of physical vapor deposition and chemical vapor deposition.

26. The composition of claim 19, wherein said structured surface includes a plurality of undercuts and said biocompatible material coats said plurality of undercuts in said structured surface.

27. The composition of claim 26, wherein said structured surface is porous and said biocompatible material coats interconnected pores beneath said structured surface.

28. The composition of claim 19, wherein said substrate includes at least one material selected from the group consisting of carbon-composite, stainless steel, cobalt-chromium, titanium alloy, tantalum, and ceramic.

29. The composition of claim 19, wherein said structured surface is defined by a material that includes a plurality of particles that are sintered together to form a continuous porous phase.

30. The composition of claim 19, wherein said structured surface is prepared by at least one method selected from the group consisting of sintering, flame spraying, acid etching, grit blasting, casting-in, forging-in, laser texturing, and micromachining.

31. The composition of claim 19, wherein said biocompatible coating includes at least one material selected from the group consisting of titanium, tantalum, carbon, calcium phosphate, zirconium, niobium, hafnium, hydroxyapatite, and tissue in-growth and/or on-growth facilitating proteins.

32 The composition of claim 19, wherein said biocompatible coating includes multi-layers.

33. The composition of claim 19, wherein said biocompatible coating includes nano-layers.

34. An osteoconductive process, comprising contacting a bone under *in vivo* conditions with said composition of claim 19.

35. An orthopedic implant, comprising said composition of claim 19.

36. A method for orthopedic surgery which comprises positioning said composition of claim 19 within a vertebrate in need thereof.

37. An implant, comprising:

a substrate;

a structured surface formed on a portion of said substrate; and

a biocompatible coating deposited on at least a fraction of said structured surface,

wherein said portion of said substrate is to be fixed with tissue in-growth and/or on-growth for stability.

38. The implant of claim 37, wherein said biocompatible coating is more biocompatible than said structured surface.

39. The implant of claim 37, wherein said biocompatible coating is more biocompatible than said substrate.

40. The implant of claim 37, wherein said biocompatible coating is softer than said structured surface.

41. The implant of claim 37, wherein said biocompatible coating is softer than said substrate.

42. The implant of claim 37, wherein said coating is formed by a thin film technique.

43. The implant of claim 42, wherein said thin film technique includes at least one deposition process selected from the group consisting of physical vapor deposition and chemical vapor deposition.

44. The implant of claim 37, wherein said structured surface includes a plurality of undercuts and said biocompatible material coats said plurality of undercuts in said structured surface.

45. The implant of claim 44, wherein said structured surface is porous and said biocompatible material coats interconnected pores beneath said structured surface.

46. The implant of claim 37, wherein said substrate includes at least one material selected from the group consisting of carbon-composite, stainless steel, cobalt-chromium, titanium alloy, tantalum, and ceramic.

47. The implant of claim 37, wherein said structured surface is defined by a material that includes a plurality of particles that are sintered together to form a continuous porous phase.

48. The implant of claim 37, wherein said structured surface is prepared by at least one method selected from the group consisting of sintering, flame spraying, acid etching, grit blasting, casting-in, forging-in, laser texturing, and micromachining.

49. The implant of claim 37, wherein said biocompatible coating includes at least one material selected from the group consisting of titanium, tantalum, carbon, calcium phosphate, zirconium, niobium, hafnium, hydroxyapatite, and tissue in-growth and/or on-growth facilitating proteins.

50. The implant of claim 37, wherein said biocompatible coating includes multi-layers.

51. The implant of claim 37, wherein said biocompatible coating includes nano-layers.

52. The implant of claim 37, wherein said implant is an orthopedic prosthesis.

53. A method for orthopedic surgery which comprises surgically positioning said implant of claim 37 within a vertebrate in need thereof.

54. An osteoconductive process, comprising contacting a bone under *in vivo* conditions with said implant of claim 37.

55. A method of forming a composite coating, comprising:

depositing a biocompatible coating on a structured surface that composes at least a portion of a surface area of a substrate.

56. The method of forming a composite coating according to claim 55, further comprising:

covering said portion of said surface area of said substrate with a mixture including a plurality of particles, said plurality of particles including a first material; and

sintering said plurality of particles to produce a porous structure,

wherein said biocompatible coating includes a second material that is different from said first material.

57. The method of claim 55, wherein depositing said biocompatible coating includes depositing a coating that is more biocompatible than said structured surface.

58. The method of claim 55, wherein depositing said biocompatible coating includes depositing a coating that is more biocompatible than said substrate.

59. The method of claim 55, wherein depositing said biocompatible coating includes depositing a coating that is softer than said structured surface.

60. The method of claim 55, wherein depositing said biocompatible coating includes depositing a coating that is softer than said substrate.

61. The method of claim 55, wherein said depositing said biocompatible coating includes forming said biocompatible coating with a thin film technique.

62. The method of claim 61, wherein said thin film technique includes at least one deposition process selected from the group consisting of physical vapor deposition and chemical vapor deposition.

63. The method of claim 55, further comprising, before the step of depositing, forming a plurality of undercuts in said structured surface, and, wherein depositing said biocompatible coating includes coating said plurality of undercuts in said structured surface.

64. The method of claim 63, wherein forming a plurality of undercuts includes forming interconnected pores beneath said structured surface, and, wherein depositing said biocompatible coating includes coating said interconnected pores.

65. The method of claim 55, further comprising, before the step of depositing, providing said substrate from at least one material selected from the group consisting of carbon-composite, stainless steel, cobalt-chromium, titanium alloy, tantalum, and ceramic.

66. The method of claim 55, further comprising, before the step of depositing, providing said structured surface from a material that includes a plurality of particles that are sintered together to form a continuous porous phase.

67. The method of claim 55, further comprising, before the step of depositing, preparing said structured surface by at least one method selected from the group consisting of sintering, flame spraying, acid etching, grit blasting, casting-in, forging-in, laser texturing, and micromachining.

68. The method of claim 55, wherein depositing said biocompatible coating includes depositing at least one material selected from the group consisting of titanium, tantalum, carbon, calcium phosphate, zirconium, niobium, hafnium, hydroxyapatite, and tissue in-growth and/or on-growth facilitating proteins.

69. The method of claim 55, wherein depositing said biocompatible coating include depositing multi-layers.

70. The method of claim 69, wherein depositing said biocompatible coating includes depositing nano-layers.

71. A method for orthopedic surgery which comprises surgically positioning an implant that includes the composite coating made by the method of claim 55 within a vertebrate in need thereof.

72. An osteoconductive process, comprising contacting a bone under *in vivo* conditions with an implant including a composite coating made by the method of claim 55.

73. An implant including a composite coating made by the method of claim 55.

74. An orthopedic prosthesis including a composite coating made by the method of claim 55.

75. The method of claim 55, further comprising, after the step of depositing, treating another portion of said surface area with ion bombardment.